

norm**NEN-EN-ISO 3381**

Railverkeer - Akoestiek - Meting van geluid binnen railgebonden voertuigen (ISO/DIS 3381:2001,IDT)

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Railway applications - Acoustics - Measurement of noise inside railbound vehicles (ISO/DIS 3381:2001,IDT)

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January 2001

ICS

English version

**Railway applications - Acoustics - Measurement of noise inside
railbound vehicles (ISO/DIS 3381:2001)**

Applications ferroviaires - Acoustique - Mesurage du bruit à
l'intérieur des véhicules circulant sur rails (ISO/DIS
3381:2001)

Bahnanwendungen - Akustik - Geräuschmessungen in
spurgebundenen Fahrzeugen (ISO/DIS 3381:2001)

This draft European Standard is submitted to CEN members for parallel enquiry. It has been drawn up by the Technical Committee CEN/TC 256.

If this draft becomes a European Standard, CEN members are bound to comply with the CEN/CENELEC Internal Regulations which stipulate the conditions for giving this European Standard the status of a national standard without any alteration.

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Preview
prEN ISO 3381

Foreword

The text of prEN ISO 3381:2001 has been prepared by Technical Committee CEN/TC 256 "Railway applications", the secretariat of which is held by DIN, in collaboration with Technical Committee ISO/TC 43 "Acoustics".

This document is currently submitted to the parallel Enquiry.

This European Standard has been prepared under a mandate (M024) given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this standard.

prEN ISO 3381:2001
Preview

1 Scope

This European Standard specifies the conditions for obtaining reproducible and comparable measurement results of levels and spectra of noise inside all kinds of vehicles on rails or other types of fixed track.

For the maintenance vehicles during operation refer to prENV xxx-1 — (“Railway applications – Track — Approval conditions for construction and maintenance machines — Part 1: Running of railbound machines”), clause 16.

The results may be used, for example:

- to characterize the acoustic comfort for passengers and crew inside these vehicles;
- to compare the noise inside various vehicles on a particular section of the track (standardized or not).

The test procedures specified in this European Standard are of engineering grade (grade 2) as defined in EN ISO 12001.

2 Normative references

This European Standard incorporates by dated or undated reference, provisions from other publications. These normative references are cited at the appropriate places in the text and the publications are listed hereafter. For dated references, subsequent amendments to or revisions of any of these publications apply to this European Standard only when incorporated in it by amendment or revision. For undated references the latest edition of the publication referred to applies (including amendments).

EN 60651, *Sound level meters (IEC 60651:1979 + A1:1993)*.

EN 60804, *Integrating-averaging sound level meters (IEC 60804:1985 + A1:1989 + A2:1993)*.

EN 60942, *Electroacoustics — Sound calibrators (IEC 60942:1997)*.

EN 61260, *Electroacoustics – Octave-band and fractional-octave-band filters (IEC 61260:1995)*.

prENV XXX-1 (WI 00256010) *Railway applications – Track — Approval conditions for construction and maintenance machines — Part 1: Running of railbound machines¹⁾*

EN ISO 266, *Acoustics – Preferred frequencies (ISO 266:1997)*.

prEN ISO 3740, *Acoustics — Determination of sound power levels of noise sources — Guidelines for the use of basic standards (ISO/DIS 3740:1998)*.

EN ISO 12001, *Acoustics – Noise emitted by machinery and equipment – Rules for the drafting and presentation of a noise test code (ISO 12001:1996)*.

IEC 60263, *Scales and sizes for Plotting frequency characteristics and polar diagrams*.

3 Terms and definitions

For the purposes of this European Standard, the following terms and definitions apply:

3.1 type test

measurement performed to prove that the vehicle delivered by the manufacturer complies with the noise specifications

1) in preparation

the conditions prescribed for each test shall be complied with as closely as possible. If unavoidable variations have to be made, these shall be stated in the test report

3.2 monitoring test

measurement performed to check that the noise of one or more vehicles, taken among individual units in a con-
signment of vehicles, is within prescribed limits or to check if the noise of the vehicle has changed since initial de-
livery or after modification

slight deviations from the specified test conditions for type tests are permissible concerning the test site, the
background noise and the operating conditions. Any variation shall be described in the test report

3.3 sound pressure level, L_p

level, in decibels given by the equation:

$$L_p = 10 \lg (p/p_0)^2 \text{ dB} \quad (1)$$

where:

L_p is the sound pressure level;

p is the sound pressure;

$p_0 = 20 \mu\text{Pa}$ is the reference sound pressure

3.4 A-weighted sound pressure level, L_{pA}

sound pressure level, in decibels, obtained by using the frequency weighting A (see EN 60651), given by the fol-
lowing equation:

$$L_{pA} = 10 \lg (p_A/p_0)^2 \text{ dB} \quad (2)$$

where:

L_{pA} is the A-weighted sound pressure level;

p_A is the A-weighted sound pressure;

$p_0 = 20 \mu\text{Pa}$ is the reference sound pressure

3.5 weighted maximum sound pressure level L_{pAFmax}

maximum value of the A-weighted sound pressure level (see 3.4), in decibels, determined during the measurement
time interval T by using time weighting F (see EN 60651)

3.6 A-weighted equivalent continuous sound pressure level, $L_{pAeq,T}$

A-weighted sound pressure level, in decibels, given by the following equation:

$$L_{pAeq,T} = 10 \lg \left(\frac{1}{T} \int_0^T \frac{p_A^2(t)}{p_0^2} dt \right) \text{ dB} \quad (3)$$

where:

$L_{pAeq,T}$ is the A-weighted equivalent continuous sound pressure level, in decibels;

T is the measurement time interval;

$p_A(t)$ is the A-weighted instantaneous sound pressure;

$p_0 = 20 \mu\text{Pa}$ is the reference sound pressure

3.7

A-weighted short term equivalent continuous sound pressure level, $L_{pAeq,1s}$

A-weighted equivalent continuous sound pressure level (see 3.6), in decibels, where the measurement time interval T is one second ($T = 1\text{s}$)

3.8

noise with impulsive character

noise which occurs as an isolated event or as one of a series of events with a repetition rate of less than 15 times per second.

3.9

noise with tonal character

noise which contains easily audible tones.

4 Measurement quantities

The quantities to be measured at all microphone positions for both type and monitoring tests are specified below.

4.1 The measurement quantity for all kinds of vehicles is the A-weighted equivalent continuous sound pressure level, $L_{pAeq,T}$

4.2 Additionally to measurements according to 4.1 the A-weighted short-term equivalent continuous sound pressure level, $L_{pAeq,1s}$, may be measured for all kinds of vehicles.

Note For research purposes it could be useful to measure and record the results collected over a time period of 10 min. to 20 min. So it would be possible to study the variation of the sound pressure level with time and to evaluate statistical quantities.

4.3 For type tests on all kinds of vehicles frequency analysis corresponding to 4.1 shall be made in one-third-octave bands according to EN ISO 266 from 31,5 Hz to 8000 Hz.

Note The results may be used to evaluate possible low-frequency noise annoyance.

4.4 In presence of noise with suspected impulsive character, at each microphone position it is necessary to make two measurements corresponding to 4.1: One with time weighting S, the other with time weighting I. (For S and I see EN 60651.)

If the difference between the two is more than 5 dB the impulsive character is conventionally confirmed.

4.5 In presence of noise with suspected tonal character, at each microphone position it is necessary to make frequency analysis measurements according to 4.3 with a minimum measurement time interval T of 10 s for each frequency band.

Instead of measuring each frequency band consecutively real-time analysis is preferred with a minimum measurement time interval T of 60 s.

If the level of one frequency band exceeds the level of both of its adjacent bands by more than 5 dB the tonal character is conventionally confirmed.

5 Instrumentation

The instrumentation system, including the microphones, cables and recording devices shall meet the requirements for a type 1 instrument specified in EN 60804.

The microphones shall be calibrated to have an essentially flat frequency response in a diffuse sound field.

The one-third-octave band filters shall meet the requirements of EN 61260.

Normally a windscreen is not to be used but, if necessary, may be used: this case shall be specified in the test report.

Before and after each series of measurements a sound calibrator with an accuracy of at least $\pm 0,3$ dB (class 1 according to EN 60942) shall be applied to the microphone(s) for verifying the calibration of the entire measuring system at one or more frequencies over the frequency range of interest. If the difference between the two calibrations is more than 0,5 dB all the measurement results must be rejected.

The compliance of the calibrator with the requirements of EN 60942 shall be verified at least once a year. The compliance of the instrumentation system with the requirements of EN 60804 shall be verified at least every 2 years.

The date of the last verification and confirmation of the compliance with the relevant European Standards shall be recorded.

6 Test conditions

6.1 Test environment

6.1.1 Acoustical environment

The test site for chiefly outside-moving vehicles shall be such that the sound radiated by the vehicle to the outside contributes to the inside noise only by reflections from the track and not by reflections from buildings, walls or similar large objects outside the track.

For vehicles moving inside tunnels (or underground) the measurement shall be carried out in real operating conditions.

In the immediate vicinity of the track, there shall be no additional absorbent covering or snow.

6.1.2 Meteorological conditions

The meteorological conditions (such as temperature, wind, rain, fog, etc.) shall be such that they do not influence the measurements.

6.1.3 Background sound pressure level

Care shall be taken to ensure that the noise from other sources (for example undesirable noise from other vehicles or noise from industrial plants) as well as spurious signals due to external influences (for example vibration of the measuring device and electromagnetic fields) do not influence the measurements.

For type tests on stationary vehicles, the A-weighted background sound pressure level measured in the stationary vehicle at the location for test with all main and auxiliary equipment turned off shall be at least 10 dB below the reading of the A-weighted sound pressure level obtained when measuring the inside noise of the vehicle in the presence of background noise.

If for type tests on vehicles in motion, for any one-third-octave band level of a frequency analysis or for monitoring tests the difference between the reading of the A-weighted sound pressure level obtained when measuring the inside noise of the vehicle in the presence of background noise and the A-weighted background sound pressure level alone is less than 10 dB the reading shall be corrected according to table 1.

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